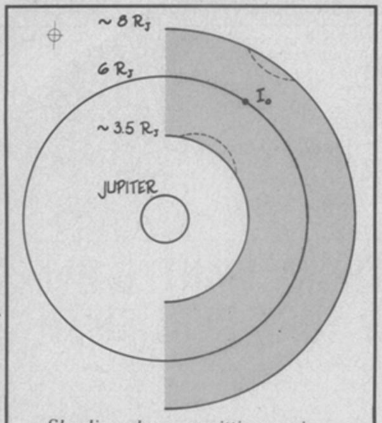
Jonathan Eberhart reports from Pasadena at the meeting of the Division for Planetary Sciences of the American Astronomical Society

Jupiter's hemi-halo of sulfur



Shading shows emitting region.

C. Pilcher/drawn by V. Zinser

The golden veil of sodium atoms around Jupiter's strange satellite Io (SN: 11/12/77, p. 332) is only one of several exotic clouds that have been detected in the Jovian system. Another consists of ionized sulfur, which, although it is 1,000 times dimmer than the sunlight-reflecting sodium, has now been partially "mapped" by Carl Pilcher and Jeff Morgan of the University of Hawaii. Although the sulfur, like the sodium, apparently comes from Io, the sulfur emissions are concentrated not around Io but in a huge half-doughnut more than a billion kilometers across, in orbit around Jupiter itself.

The distribution of the emissions (at 6713 and 6716 angstroms) was plotted by taking a number of individual slit spectra at times when the Jovian magnetic equator—along which the sulfur ions are generally confined—was at different angles to the earth. The researchers also positioned the slits on opposite sides of Jupiter and when Io was in different positions.

The results indicate that the inner edge of the emitting region is about 3.5 times Jupiter's radius ($3.5R_J$) from the center of the planet. (Jupiter's radius is more than 70,000 km, and researchers typically speak in multiples of the radius as a way of relating a planet's size to the size of its magnetic field and other external features.) The outer edge reaches as far as about 8 Jovian radii from the center. It extends less than one radius above and below the magnetic equator.

The limited observations suggest that the emitting region rotates with Jupiter's rotational period of slightly more than 10 hours, since the sulfur ions are trapped by the planet's magnetic field lines. Io orbits the planet at a distance of about 6 Jupiter radii from the center, so it travels through the "cloud," and the Hawaii researchers believe they see indications of a slight narrowing of the emitting region where the little satellite is passing. Io passes over the same point on Jupiter about every 13 hours (a combination of the planet's rotational period and Io's period of revolution around Jupiter), and the scientists plan to gather additional spectra for signs that the narrowing indeed follows the same 13-hour periodicity.

More watery asteroids

Though the compositions of asteroids have been studied for many years, it was not until 1977 that Larry Lebofsky of the University of Arizona was able to report the first detection of water of hydration (such as found in clays) on an asteroid, in this case, the one known as 1 Ceres. Now he has expanded the list, using infrared reflectance spectra made with the 154- and 71-cm telescopes at Mt. Lemmon Observatory.

Ceres has posed something of a quandary. Lebofsky detected as much as 15 percent water by weight in the asteroid's surface material, yet other spectra have indicated it to be a carbonaceous chondrite of the water-poor type IV, in contrast to the more water-rich types I and II. Now there is another such oddity, 2 Pallas, which shows about 5 percent water despite having also been identified as a type IV. Less problematically, water has also been indicated on 19 Fortuna and 52 Europa, both type IIs, and on 72 Feronia, which is unclassified. There have been possible detections of water for 51 Nemausa, 144 Vibilia and 404 Arsinoe, all of which are type Is or IIs.

On the other hand, water failed to show up when it was expected on a type II called 554 Paraga and is apparently lacking on a type I or II known as 324 Bamberga. This is somewhat less surprising than the reverse case, since heating due to meteorite bombardments, collisions or other sources could have driven some of the water away. As expected, water also failed to show up on several *non*carbonaceous asteroids, including 4 Vesta (tentatively classed as a eucrite), 14 Irene (a stony-iron type), 28 Bellona (stony) and 349 Dembowska (an achondrite). Water on one of those, Lebofsky says, "would really be tough to explain."

Triton, Pluto: Methane atmospheres?

Triton, Neptune's larger moon, shows infrared spectral evidence for an atmosphere containing methane, according to Dale Cruikshank of the University of Hawaii and Peter Silvaggio of the NASA Ames Research Center. Spectra made with the Kitt Peak 4-meter telescope showed an absorption feature at a 2.3-micron wavelength, which could represent either methane gas or frozen methane on the surface, but little or no characteristic frozen-methane feature at 1.7 microns.

Methane gas there thus appears to be, but not much, according to Cruikshank's calculations: A comparison of infrared and visible-wavelength measurements, he says, puts an upper limit of about 5,000 km on Triton's diameter, and some yet-unpublished visual spectrophotometry supports the idea that the surface is a rocky one. Assuming the 5,000-km size and a density like that of earth's moon, Cruikshank estimates the partial pressure of the atmosphere's methane to be only about 0.1 millibar.

The Hawaii researchers have also detected methane on Pluto, but in the form of surface ice, confirming the 1976 finding by Cruikshank and some other colleagues (SN: 4/10/76, p. 228). The new measurements, made with a detector offering 10 times the resolution of the old one, show no signs of atmospheric methane, but Cruikshank is confident that it is there. Vapor-pressure calculations, he says, imply an atmosphere for Pluto with a methane partial pressure of a tiny but extant 0.08 mb.

Meteorites and their parents

Early in 1977, some scientists raised the intriguing possibility that the asteroid 4 Vesta might be the source, or "parent body," of a rare class of basaltic meteorites known as eucrites (SN: 1/29/77, p. 72). This would make the eucrites the only extraterrestrial samples besides the Apollo moonrocks whose specific point of origin was known. Now Michael Feierberg and colleagues from the University of Arizona have blurred the issue somewhat by proposing a second possible eucrite source—the asteroid 349 Dembowska — but they have in turn suggested another tentative link: that Dembowska itself may be the parent body of an even rarer meteorite type, a one-of-a-kind achondrite recovered last winter in Antarctica (SN: 7/15/78, p. 37).

The mineral assemblage proposed for the eucrite parent body by the previous researchers, Feierberg says, should have an infrared spectrum about like that his group recently measured for Dembowska. In detail, however, Dembowska's IR spectrum "is unlike that of any known meteorite," though it is at least consistent with a calcium-poor achondrite-type composition whose olivine-pyroxene ratio falls between two meteorite classes known as Chassignites and Diogenites. The newly found Antarctic achondrite, unique among more than 300 meteorites collected by a U.S.-Japanese team headed by the University of Pittsburgh's William A. Cassidy, has, according to Feierberg, just such an "intermediate" composition.